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Simulation Study of Dual Band Damru Shaped Square Patch Wide Band Microstrip Antenna

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***Abstract*: A single feed compact, low profile damru shaped square patch microstrip antenna with Diclad Substrate is studied in this paper. The antenna has been designed for C-Band. Diclad 522 substrate of 2.5 dielectric constant has excellent dimensional stability and low loss.it has been observed that antenna shows dual band response with high directivity, gain and large Radiation efficiency. The feed location of (0, 10) is the optimized value for my design. It has been also observed that antenna shows better response when feeding is done at Y-axis (0, 10) i.e. this design not properly work when feeding is introduced in (x, y) axis.**

***Keywords*: square patch, Radiation efficiency, Directivity, Gain and feed points.**

1. Introduction

In recent years, wireless communication systems such as (WiMAX), wireless local area network (WLAN) and C-Band has been widely used [1]. Therefore, the demand for low-profile antennas with compact size, and multiband operation covering the bands of these applications, the significant advantage to dual band antennas is their ability to provide a strong, stable wireless connection [2]. Microstrip patch antennas are becoming increasing useful because they can be printed directly into circuit board. Microstrip patch antenna is defined as planer resonant cavities that leak from their edges and radiate. Due to its compact size, MSA of different shapes are becoming popular in recent time in various applications. For designing compact size, higher dielectric constants must be used which are less efficient and result in narrower bandwidth. Lower dielectric constant enhances the BW [3]. To overcome the problem of narrow bandwidth, a lots of antennas of different shapes of patches like trishul shaped, arrow shaped, U shaped, E-shaped, L-shaped, star shaped, diamond shaped [4] and also slots of different shapes have been studied. In the present investigation, effort has been focused on simulation studies of damru shaped square patch antenna by using contacting feeding scheme of high directivity, high gain and better efficiency and bandwidth.

2. Geometry of patch

The Fig. 1 depicts the layout of coaxial probe feed damru shaped square patch antenna. The proposed antenna designed on Diclad 522 substrate at feed location (0, 10).

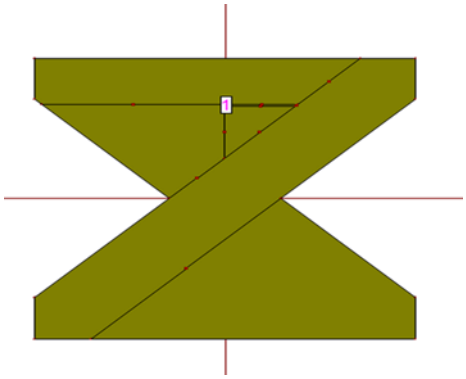

Fig. 1. Layout of coaxial probe feed damru shaped square patch antenna

A. Design parameters

Height of substrate = 1.57mm
Dielectric constant of substrate = 2.5
Loss tangent tanδ=0.002
Square of sides= 30mm

To investigate the performance of the proposed antenna configuration, IE3D Simulation Software is used.

3. Results and discussion

The table 1 shows the results of design at feed point (0,10). The fig. 2, shows the return loss value -22.92 at 6.97GHz resonant frequency and -25.74 at 7.39GHz frequency which are less than -10 dB.

From the fig. 3 it has been observed that voltage stand wave ratio (VSWR) value lies between 1 and 2 for both center frequencies which indicate good impedance matching.

Table 1
Results of design at feed point (0, 10)

Center freq	Return loss	VSWR	Real impedance(Ω)	Efficiency	Gain(dB)	Directivity(dB)
6.97	-22.92	1.15	55.53	48.80	4.97	8.10
7.39	-25.74	1.109	53.44	50.85	5.12	8.5

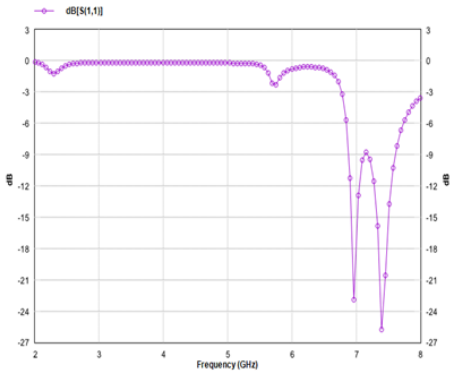

Fig. 2. Return loss plot

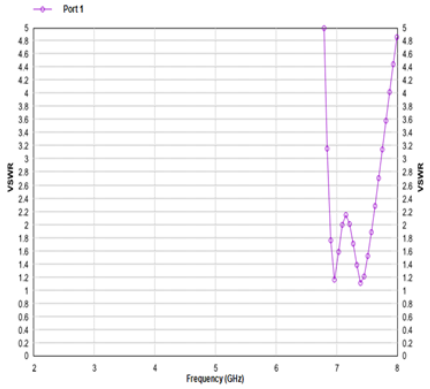

Fig. 3. VSWR

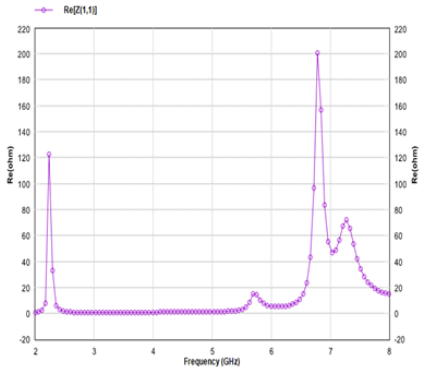

Fig. 4. Real impedance plot

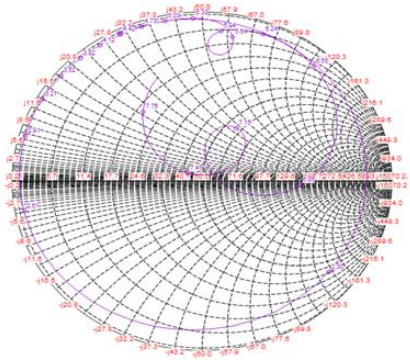

Fig. 5. Smith chart

The Fig. 4 shows Real value of impedance nearly 50 ohm at resonant frequencies of 6.97 and 7.39GHz. The width of antenna controls the input impedance. Larger widths can also increase the Bandwidth.

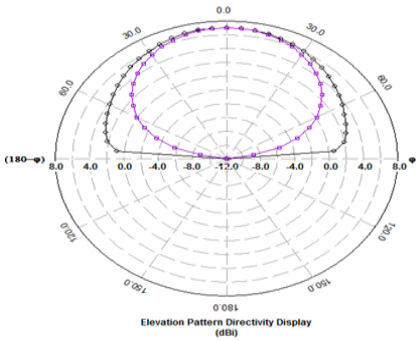

Fig. 6. Radiation pattern

Radiation pattern shows an electromagnetic power distribution in free space. Fig. 5 shows better gain and directivity y.

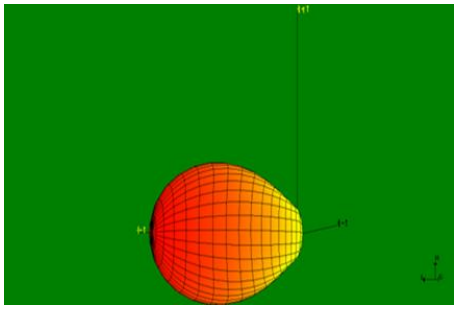

Fig. 7. 3D Radiation pattern

Fig. 7. shows 3D view of antenna of high directivity and gain.

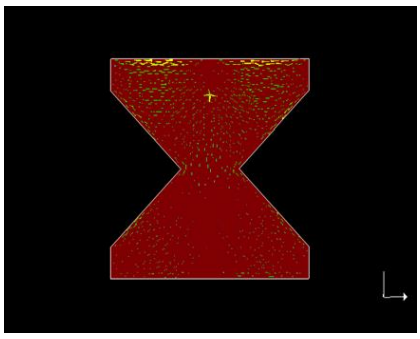

Fig. 8. Current distribution

Above figure shows distribution of current in damru shaped antenna.

4. Conclusion

In this paper, detailed analysis of antenna of damru shaped on the parameters such as resonant frequency, bandwidth, return loss, VSWR, gain and directivity etc. have been studied by using IE3D simulation software. It has been observed that

this antenna gives high gain, directivity and efficiency without any design complexity. My design operates on two bands or frequencies 6.97GHz and 7.39GHz. It can either work on these different frequencies one at a time or simultaneously and it covers the useful frequency band of today's communication system such as C-band 7.25 GHz (6.97GHz – 7.39 GHz).

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